Compound nucleus spin distribution for ^{64}Ni + ^{100}Mo *

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In the last decades, a number of measurements have been performed to understand the fusion reaction dynamics and to obtain an experimental representation of the barrier distribution D_b using precisely measured fusion excitation functions [1]. As an alternative approach to this the employment of the compound nucleus (CN) spin distribution σ_ℓ (SD) was proposed [2]:

$$D_b = \frac{dT_{E'}}{dE'} \tag{1}$$

with

$$E' = E - \frac{\ell(\ell+1)}{2\mu R_b^2} \tag{2}$$

and

$$\sigma_\ell(E) = T_\ell(E,\ell)(2\ell+1)\pi\lambda^2, \tag{3}$$

where T is the transmission as a function of the spin ℓ or the energy E' as defined above, μ the reduced mass of the colliding system, λ the de Broglie wave length and R_b the barrier radius.

To explore aspects like the fusion-fission competition, the role of deformation in fusion of a heavy system and the possible effect of the Z=82 shell closure on enhancement of evaporation residue (ER) cross-sections, a series of experiments has been performed to measure the SD for ^{64}Ni, ^{34}S and ^{48}Ca induced reactions using the γ detector array GASP at the Laboratori Nazionali di Legnaro, Legnaro (PD), Italy. The GASP array consisted of 80 BGO detectors (total efficiency $\approx$ 80 % as a multiplicity filter) and 40 HPGe detectors (used for identification of ERs) In the present work, we are reporting on the results for the reaction ^{64}Ni + ^{100}Mo at beam energies ranging from 230 MeV to 260 MeV. The experimentally recorded data is used to obtain the fold distribution of each ER channel by gating the fold spectrum with respective characteristic γ transitions. In an earlier measurement at the Argonne/Notre Dame Crystalball integral ER data had been obtained with

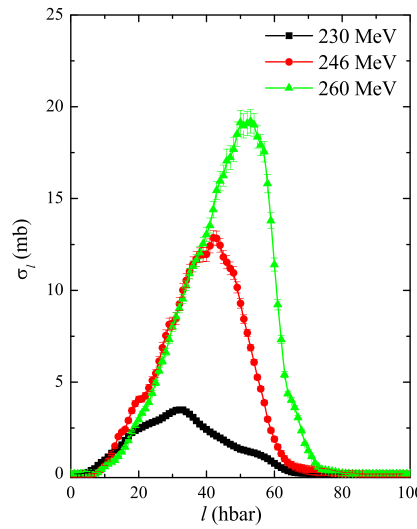

Figure 1: A comparison of the spin distribution at different beam energies.

some limitations in accuracy for spin and cross section assignment [4]. These fold distributions are converted into multiplicity distributions using the response function of the detector array. Finally the multiplicity distributions are converted to σ_ℓ distributions using eq. 2 in Ref. [3]. The comparison of the SDs at the three measured beam energies is shown in Fig. 1. It is observed that the high spin tail of the SD becomes steeper and steeper with increasing beam energy. With increasing beam energy fission starts competing with ER production and the partial wave with higher spin end up as fission which results in cutting of the SD at the high spin end. The extraction of D_b from those spin distributions is presently being pursued and will be reported soon.

References

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